5.0 MEASURES OF EFFECT

Measures of effect are the COPC TRVs used to assess toxicity to the measurement receptors. This section describes the TRVs for the COPCs targeted in the quantitative evaluation. The sections below (1) describe the procedures for identifying the TRVs, (2) discuss the U.S. EPA-recommended TRVs, and (3) discuss TRVs obtained from other sources.

5.1 IDENTIFICATION OF TOXICITY REFERENCE VALUES

The potential risk to a community or guild from exposure to a COPC will be quantified by comparing an EEL to a TRV, specific to each COPC and measurement receptor. As recommended in the SLERAP (U.S. EPA 1999), TRVs identified for the Phase I ERA represent COPC concentrations or doses that do not adversely affect (i.e., no observed adverse effect level [NOAEL]) an ecologically relevant endpoint of a receptor exposed for a chronic (long-term) duration.

The following subsections describe the sources used to compile available TRVs for selected COPCs and the derivation of TRVs for chemical warfare agents. TRVs presented in the SLERAP (U.S. EPA 1999) were used as the primary source of TRVs for the Phase I ERA. For selected COPCs not included in the SLERAP, TRVs compiled and presented in the "Revised Protocol, RCRA Part B Risk Assessment No. 39-26-1299-99, Anniston Chemical Agent Disposal Facility (ANCDF), Anniston, Alabama" (USACHPPM 2002) were used.

TRVs are presented in Tables E-1 through E-7 in Appendix E. The tables present information about the basis of each, including the (1) source of the toxicity value; (2) study receptor, duration, and endpoint; and (3) uncertainty factors (UF).

5.2 U.S. EPA-RECOMMENDED TRVs

TRVs listed in the SLERAP (U.S. EPA 1999), if available, will be used in the Phase I ERA to assess toxicity to surface water receptors, soil receptors, sediment receptors, birds, and mammals.

TRVs provided in the SLERAP for surface water, sediment, and soil receptors were identified from available screening values and toxicity values. For compounds with no screening value, TRVs were

computed using toxicity values from available literature. The equilibrium partitioning approach was used to compute several sediment TRVs.

In order to provide a conservative estimate of toxicity for the Phase I ERA, TRVs presented in the SLERAP for avian and mammalian measurement receptors represent the lowest available toxicity value for a particular COPC across orders in Class *Aves* and across orders in Class *Mammalia*.

As recommended in the SLERAP, UFs were applied to toxicity values, as necessary, to convert a toxicity value to a TRV reflecting a NOAEL for chronic exposure duration.

5.3 TOXICITY REFERENCE VALUES FROM OTHER SOURCES

TRVs presented in the Anniston protocol for compounds not listed in U.S. EPA (1999) were compiled and evaluated for use in the Phase I ERA. In addition, TRVs for the three chemical agents were calculated. The Anniston TRVs and the calculation of the agent TRVs are discussed below.

5.3.1 Toxicity Reference Values from the Anniston Chemical Agent Disposal Facility Ecological Risk Assessment Protocol

Toxicity information identified in the ANCDF ERA protocol (USACHPPM 2002) includes TRVs for several compounds that are also detected in emissions from the TOCDF and CAMDS units. For selected COPCs not included in the SLERAP, TRVs identified in the ANCDF Protocol will be used to assess toxicity for these COPCs. These TRVs were first evaluated to assess exposure durations and study endpoints. UFs were applied to toxicity values, as necessary, to convert a toxicity value to a TRV reflecting a NOAEL for chronic exposure duration.

COPCs for the Phase I ERA for which TRVs from ANCDF ERA Protocol were adopted include the following:

- Ethylbenzene
- n-Hexane
- Bromoform
- 1,1,2,2-Tetrachloroethane
- Benzoic acid
- Benzyl alcohol
- RDX

- 2,4,6-Trinitrotoluene
- Decane
- Boron
- Di-n-butylphthalate
- Diethylphthalate

Toxicity benchmarks identified in the ANCDF ERA Protocol include benchmarks for surface water receptors, soil receptors, sediment receptors, birds, and mammals.

5.3.2 Determination of Agent Toxicity Reference Values

While health-based toxicity benchmarks have been calculated for chemical agents (USACHPPM 1999b), no toxicity benchmarks for ecological receptors are available. These health-based benchmarks are based on studies on rodents. Agent TRVs were determined from information in "Chemical Warfare Agents: Estimating Oral Reference Doses" (Opresko and others 1998). For each agent, Opresko and others (1998) reviewed available toxicological literature and selected a key study from which to develop reference doses for each agent. These key studies were used to derive the TRVs (for mammals only) following U.S. EPA (1999) methods, including the application of UFs.